# 1 Introduction

1.1 This Memorandum deals with the methods to be used to forecast the levels of future traffic on roads in rural areas. Such estimates are required in order to establish the road design which will meet future traffic needs and also to enable the economic worth of road projects to be evaluated.

1.2 The data and methods described relate particularly to rural roads. In urban areas the effects of congestion and policies which restrict growth are such as to preclude the general application of the methods set out in this Memorandum. However, the growth factors may need to be modified before they can be applied to roads which exhibit some of the characteristics of urban roads e.g. commuting.

1.3 This Memorandum supersedes sections 2 and 3 of Memorandum No. 780. It is based on the latest available forecasts and will be revised from time to time as new and improved estimates become available.

1.4 A general procedure which will be found satisfactory for most schemes is summarised below. The remainder of this Memorandum follows this general sequence:

(a) Study of proposed scheme to determine the extent of basic information necessary, e.g directional peak flows or average daily flows. Also what traffic censuses or Origin and Destination surveys are already available or are required.
(b) Execution of any traffic counts or origin and destination surveys necessary and analysis of all material—including conversion of data to common units (passenger car units and August or other busiest month traffic levels).
(c) Application of appropriate forecast increases to this basic data taking into account the chosen design period, the effects of diverted and generated traffic, other road improvements and town developments.
(d) Consider the economics of alternative schemes including stage construction.

# 2 Basic Data Requirements

### 2.1 Traffic Surveys

The basis of most estimates of future traffic is existing traffic levels, but in some cases the use of traffic models will be appropriate. Traffic counts, censuses or origin and destination surveys can be used depending on the nature of the scheme. In forecasting future traffic on rural roads between junctions the object is to obtain the future average daily flow which must be accommodated a certain number of years ahead (the design period: see section 5.1). For this purpose traffic counts are taken to obtain the seven day average—6 a.m. to 10 p.m.—occurring in the busiest month of the year, usually August. From this information the required future design can be worked out using the data set out in section 3.20 of the Manual on the Layout of Roads in Rural Areas.

2.2 Road Junction design requires information obtained from directional censuses taken to measure the heaviest traffic flows normally occurring but avoiding obviously unrepresentative exceptional flows. Here again, data is required in respect of the busiest month but the most critical flows at junctions may result from individual directional peak flows or from a combination of flows at other than peak times. Individual junctions should cater for normal variations during the week. To meet these requirements it is necessary as a minimum to take hourly directional counts in August (or other busiest month) on Saturday, Sunday and a weekday. Further counts are often advantageous, and will be necessary at junctions where peak conditions do not occur on the days covered by the census; they may be limited to the critical periods only.

**2.3** The best existing national source of data is the 1965 Trunk Road Census. This covered some 2,200 points in Great Britain at whicb counts were taken on four consecutive days in August, from 6 a.m. to 10 p.m. At 800 of tbese points counts were also taken in February, May and November; the numbers of each category of vehicle type were recorded hourly. This information will frequently be found of use either on roads forming a continuation from the point at whicb the census was taken or in conjunction with other local traffic counts. Traffic counts not more than 6 years old can usually be considered reliable provided no major change in conditions bas taken place.

**2.4** For major schemes estimates will be needed of the current level of traffic expected to use the road and this will require an origin and destination survey. This applies particularly to by-passes or long sections of new road which would attract traffic away from existing roads. The origin and destination data must be sufficiently comprehensive to cover all roads likely to be affected by the scheme: this will also apply to smaller schemes where a simple traffic count is inadequate because of traffic diversion to other routes. It is also important to take account of improvements to other roads (see section 4.4 and 4.5).

### 2.5 Passenger car units (p.c.u's)

Different classes of vehicles vary in size and performance and require different amounts of road space. Traffic counts must take account of these differences and where automatic counting equipment is used it will be necessary to take a series of representative manual counts to establish the proportions of each vehicle type.

**2.6** To allow for the size and performance variations in making capacity measurements for roads and junctions, traffic volumes are expressed in passenger car units (p.c.u's); the basic unit is the car and other vehicles are converted to this unit by applying a conversion factor. Different types of vehicle affect the capacities of rural roads, urban roads, roundabouts and traffic signals in varying degrees and appropriate adjustments have therefore to be made to the conversion factors for each class of vehicle to suit the circumstances. The values for different types of vehicles under different conditions are set out in Table 1.

**Table 1**

| Class of Vehicle | Equivalent value in P.C.U's | | | |
|---|---|---|---|---|
| | Rural Standards | Urban Standards | Round-about Design | Traffic Signal Design |
| Private cars, motor cycle combinations, taxis and light goods up to 30 cwt. unladen | 1.00 | 1.00 | 1.00 | 1.00 |
| Motor cycles (solo) scooters and mopeds | 1.00 | 0.75 | 0.75 | 0.33 |
| Goods vehicles over 30 cwt. unladen and horse drawn vehicles | 3.00 | 2.00 | 2.80 | 1.75 |
| Buses, coaches, trolley vehicles | 3.00 | 3.00 | 2.80 | 2.25 |
| Pedal cycles | 0.50 | 0.33 | 0.50 | 0.20 |

For most rural design purposes 'Rural Standards' will be appropriate: in dealing with roundabouts the small difference in the standards is seldom of sufficient importance to merit any distinction when forecasting future traffic. For traffic signals an approximate estimate can be made by multiplying the traffic volume in p.c.u's (rural standards) by 0.80.

### 2.7 'August' Level

The traffic information required for forecasting future levels should normally be based on the month during which the existing heaviest traffic levels occur (usually August). It follows that where data is obtained at times other than during the busiest month it is necessary to apply conversion factors.

**2.8** Table 2 shows the average monthly pattern in recent years.

**Table 2**

| Month | Percentage of Average Month |
|---|---|
| January | 71 |
| February | 77 |
| March | 88 |
| April | 100 |
| May | 108 |
| June | 116 |
| July | 123 |
| August | 126 |
| September | 115 |
| October | 101 |
| November | 90 |
| December | 84 |

**2.9** Table 3 sets out the multiplying factors needed to convert to August level p.c.u's the results of counts taken in other months. As a general rule counts taken between November and March should not be used to determine August levels and on holiday routes it is essential that the basic information should be obtained between the months of June and September, inclusive. Where the busiest month is not August, conversion factors will have to be worked out using local data.

**2.10** Where counts are taken other than in August, it is necessary to know for forecasting purposes the August p.c.u./vehicle ratio which corresponds with that observed in the month in which the traffic count was taken. The appropriate values are given in Table 4.

**Table 3**

| P.C.U./Vehicle Ratio | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Month of Count | Multipliers to give August Levels | | | | | | | | | |
| April | 1.46 | 1.41 | 1.36 | 1.31 | 1.27 | 1.24 | 1.21 | 1.18 | 1.15 | 1.13 |
| May | 1.20 | 1.16 | 1.14 | 1.13 | 1.11 | 1.10 | 1.09 | 1.08 | 1.07 | 1.06 |
| June | 1.22 | 1.18 | 1.16 | 1.12 | 1.10 | 1.09 | 1.07 | 1.05 | 1.03 | 1.02 |
| July | 1.16 | 1.03 | 1.01 | 1.00 | 0.98 | 0.96 | 0.96 | 0.95 | 0.94 | 0.93 |
| September | 1.18 | 1.14 | 1.12 | 1.11 | 1.09 | 1.07 | 1.05 | 1.04 | 1.02 | 1.01 |
| October | 1.36 | 1.31 | 1.27 | 1.24 | 1.20 | 1.17 | 1.15 | 1.13 | 1.10 | 1.08 |

**Table 4**

| P.C.U./Vehicle Ratio in Month of Count | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Month of Count | P.C.U./Vehicle Ratio in August | | | | | | | | | |
| April | 1.1 | 1.15 | 1.2 | 1.25 | 1.35 | 1.45 | 1.5 | 1.6 | 1.7 | 1.8 |
| May | 1.1 | 1.2 | 1.25 | 1.35 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 |
| June | 1.1 | 1.2 | 1.25 | 1.35 | 1.4 | 1.5 | 1.6 | 1.75 | 1.85 | 1.95 |
| July | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
| September | 1.1 | 1.2 | 1.25 | 1.35 | 1.4 | 1.5 | 1.6 | 1.8 | 1.9 | 2.0 |
| October | 1.1 | 1.15 | 1.2 | 1.3 | 1.4 | 1.45 | 1.55 | 1.65 | 1.75 | 1.85 |

# 3 Traffic Growth

### 3.1 The Background

When the volume and pattern of traffic using an existing road or network of roads has been determined, it is usually necessary to forecast traffic over a considerable period. Past rates of growth are not a reliable guide beyond the next few years. The factors determining the growth of road traffic are many and complex and will not necessarily act in the same way as in the past.

3.2 It is useful to consider the factors affecting the two sectors of road traffic which between them accounted for 95% of the total vehicle miles run on rural trunk and classified roads in Great Britain in 1965. Car traffic is the largest as well as the fastest growing sector and in 1965 accounted for 75% of the total vehicle miles. Car ownership has in the past grown much more quickly than population and incomes, and further very large increases must be expected. But as more households possess a car, and the number with more than one car rises, the rate of increase will slow down, even though the time when the number of cars per head ceases to grow may be a long time in the future. Making up the other main component of motor traffic are goods vehicles. The heavier (over 1½ tons unladen weight) and light vehicles accounted for 11% and 9% respectively of the total vehicle miles on rural trunk and classified roads in 1965. Future growth of goods vehicle traffic depends mainly on the rate of industrial growth, but changes in the amount of road transport required per unit of output, relative costs, and the productivity of vehicles per mile run are contributory factors.

3.3 The remaining categories of traffic, predominantly buses, coaches, and motor cycles, usually account for only a relatively small proportion of total traffic and the future growth of these classes is not likely to be significant in the overall estimate.

3.4 Because of the uncertainties surrounding the possible future growth of population, incomes, production, and hence, traffic the forecasts made must necessarily be subject to frequent review. Table 5 shows past and forecast future trends of traffic in Great Britain based on the best information available now. The actual and estimated motor vehicles per head of population are also shown. The rate of growth forecast is at first similar to the actual increase in recent years, but it declines progressively in later years.

**Table 5**

| Traffic Growth on Rural Roads in Great Britain | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1970 | 1975 | 1980 | 1985 | 1990 | 1995 | 2000 |
| P.C.U. Miles (1958 = 100) | 100* | 110* | 116* | 124* | 129* | 137* | 149* | 159* | 213† | 266† | 311† | 347† | 376† | 401† | 425† |
| Motor vehicles per head of population | 0.16* | 0.17* | 0.18* | 0 19* | 0.20* | 0.22* | 0.23* | 0 25* | 0.33† | 0.40† | 0.45† | 0.48† | 0.50† | 0.51† | 0.52† |

*Actual.
†Forecast.

**3.5** It should be noted that the estimates exclude pedal cycles. This is a small and diminishing proportion of the total and can usually be disregarded. If pedal cycle traffic is a significant feature in a particular case (say more than 10% of the vehicular flow), it will have to be treated separately; the best assumption in these cases is normally that the volume of pedal cycle traffic will remain at its present level.

**3.6** Although traffic obviously does not increase at a uniform rate on all roads adequate data is unlikely to be available locally on which to base forecasts for individual roads and schemes. Local traffic data is often distorted by purely local factors and may well give past trends dissimilar to the national pattern; projection of these into the future would merely perpetuate the distortions. There is seldom any basis for assuming a higher or lower long-term rate of growth than that indicated by the national trend and it is recommended that the volume of traffic expected by the end of the design period (see section 5.1) should be estimated using national data. Where however specific changes in local conditions can be foreseen, allowance should be made for their probable effect; this is discussed in section 4.

### 3.7 Estimating Future Traffic Growth

Table 6 sets out the forecast percentage increases in traffic from any given base year, i.e. the year of the traffic count. The base years are 1958–1970 inclusive and forecasts are made up to the year 2000.

**3.8** The table assumes an average composition of traffic at the base year and as the expected increase for heavy vehicles is lower

**Table 6 Traffic Forecast Table**

| BASE YEAR | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FUTURE YEAR | PERCENTAGE INCREASE OVER BASE YEAR | | | | | | | | | | | | |
| 1965 | 59 | 44 | 37 | 28 | 23 | 16 | 7 | 0 | — | — | — | — | — |
| 6 | 70 | 54 | 46 | 37 | 32 | 24 | 14 | 7 | 0 | — | — | — | — |
| 7 | 81 | 64 | 55 | 46 | 40 | 32 | 22 | 14 | 6 | 0 | — | — | — |
| 8 | 92 | 73 | 65 | 55 | 49 | 40 | 29 | 20 | 13 | 6 | 0 | — | — |
| 9 | 102 | 83 | 74 | 63 | 57 | 48 | 36 | 27 | 19 | 12 | 6 | 0 | — |
| 1970 | 113 | 93 | 83 | 72 | 65 | 56 | 43 | 34 | 25 | 18 | 11 | 5 | 0 |
| 1 | 124 | 103 | 92 | 81 | 74 | 64 | 51 | 41 | 32 | 24 | 17 | 11 | 5 |
| 2 | 135 | 113 | 102 | 89 | 82 | 72 | 58 | 48 | 38 | 30 | 23 | 16 | 10 |
| 3 | 146 | 122 | 111 | 98 | 90 | 79 | 65 | 54 | 44 | 36 | 28 | 21 | 15 |
| 4 | 156 | 132 | 120 | 107 | 99 | 87 | 72 | 61 | 51 | 42 | 34 | 27 | 20 |
| 1975 | 166 | 141 | 129 | 115 | 107 | 95 | 79 | 67 | 57 | 47 | 39 | 32 | 25 |
| 6 | 176 | 150 | 137 | 123 | 114 | 102 | 85 | 73 | 62 | 53 | 44 | 36 | 29 |
| 7 | 185 | 158 | 145 | 130 | 121 | 108 | 92 | 79 | 68 | 58 | 49 | 41 | 34 |
| 8 | 194 | 166 | 153 | 137 | 128 | 115 | 98 | 85 | 73 | 63 | 54 | 45 | 38 |
| 9 | 203 | 174 | 160 | 144 | 135 | 121 | 104 | 90 | 78 | 67 | 58 | 50 | 42 |
| 1980 | 211 | 182 | 167 | 151 | 141 | 127 | 109 | 95 | 83 | 72 | 62 | 54 | 46 |
| 1 | 219 | 189 | 174 | 157 | 147 | 133 | 114 | 100 | 88 | 76 | 66 | 58 | 50 |
| 2 | 226 | 195 | 180 | 163 | 153 | 138 | 119 | 105 | 92 | 80 | 70 | 61 | 53 |
| 3 | 233 | 202 | 186 | 169 | 159 | 144 | 124 | 110 | 96 | 84 | 74 | 65 | 56 |
| 4 | 240 | 208 | 192 | 174 | 164 | 149 | 129 | 114 | 100 | 88 | 78 | 68 | 60 |
| 1985 | 247 | 214 | 198 | 180 | 169 | 153 | 133 | 118 | 104 | 92 | 81 | 71 | 63 |
| 6 | 253 | 219 | 203 | 185 | 174 | 158 | 137 | 122 | 108 | 95 | 84 | 74 | 65 |
| 7 | 259 | 225 | 208 | 189 | 178 | 162 | 141 | 126 | 111 | 98 | 87 | 77 | 68 |
| 8 | 265 | 230 | 213 | 194 | 183 | 166 | 145 | 129 | 115 | 102 | 90 | 80 | 71 |
| 9 | 270 | 235 | 218 | 199 | 187 | 171 | 149 | 133 | 118 | 105 | 93 | 83 | 74 |
| 1990 | 276 | 240 | 223 | 203 | 192 | 175 | 153 | 136 | 121 | 108 | 96 | 86 | 76 |
| 1 | 281 | 245 | 228 | 208 | 196 | 179 | 156 | 140 | 124 | 111 | 99 | 88 | 79 |
| 2 | 286 | 250 | 232 | 212 | 200 | 182 | 160 | 143 | 127 | 114 | 102 | 91 | 81 |
| 3 | 291 | 254 | 236 | 216 | 203 | 186 | 163 | 146 | 130 | 116 | 104 | 93 | 84 |
| 4 | 296 | 259 | 240 | 220 | 207 | 189 | 166 | 149 | 133 | 119 | 107 | 96 | 86 |
| 1995 | 301 | 263 | 245 | 224 | 211 | 193 | 170 | 152 | 136 | 122 | 109 | 98 | 88 |
| 6 | 306 | 268 | 249 | 228 | 215 | 197 | 173 | 155 | 139 | 125 | 112 | 101 | 90 |
| 7 | 311 | 272 | 253 | 231 | 219 | 200 | 176 | 158 | 142 | 127 | 114 | 103 | 93 |
| 8 | 316 | 276 | 257 | 235 | 222 | 204 | 179 | 161 | 144 | 130 | 117 | 105 | 95 |
| 9 | 320 | 281 | 261 | 239 | 226 | 207 | 182 | 164 | 147 | 132 | 119 | 108 | 97 |
| 2000 | 325 | 285 | 265 | 243 | 230 | 211 | 186 | 167 | 150 | 135 | 122 | 110 | 99 |
| BASE YEAR | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
| STANDARD P.C.U. RATIO VEHICLE FOR BASE YEAR | 1.34 | 1.33 | 1.31 | 1.30 | 1.29 | 1.29 | 1.28 | 1.27 | 1.26 | 1.25 | 1.25 | 1.24 | 1.23 |

than for cars the overall growth rates for other compositions of traffic will be different; traffic with an above average proportion of heavy vehicles will have a lower than average growth rate, and vice versa. The average composition of traffic for each base year is given at the foot of the Table 6, in terms of a p.c.u./vehicle ratio.

**3.9** Different compositions revealed by counts and surveys should be corrected by reducing the percentage increase given in Table 6 by 6% for each 0.10 by which the observed p.c.u./vehicle ratio in the base year exceeds the average ratio shown at the foot of Table 6. In the same way an increase of 6% should be made for each 0.10 by which the observed ratio is less than the average.

**3.10** An example, showing the method of calculation, is given below.

Example: (1) Year of Count (base year) ..... 1960
(2) Design Year ..... 1988
(3) Traffic* in p.c.u's (August of base year) 9500 p.c.u's/day.
(4) Traffic* in Vehicles (August of base year) 5800 v/day.

From (1) and (2) and use of Table 6, the forecast increase in traffic is 213%.

From (3) and (4) the $\frac{\text{p.c.u.}}{\text{vehicle}}$ ratio in base year = 1.64

From Table 6, (at foot of table) $\frac{\text{Standard P.C.U.}}{\text{vehicle}}$ ratio in base year = 1.31

Difference = 0.33

Allowing 6% decrease for each 0.10 variation gives a corrected percentage of $\frac{6 \times 0.33}{0.10} = 19.8\%$.

Hence corrected percentage = $\frac{213(100 - 19.8)}{100} = 171\%$

Hence volume in design year = 2.71 × 9500
= 25700 p.c.u's/day.

*If the traffic count was not taken in August, the August flow and any variation in the $\frac{\text{p.c.u.}}{\text{vehicle}}$ ratio from August should be calculated from Tables 3 and 4.

**3.11** For certain calculations, e.g. justification of climbing lanes, some estimate will be needed of the p.c u./vehicle ratio at the design year. The following table gives an estimate of values from base years 1965–70.

| *p c.u./vehicle ratio at base year* | *Design year in 15 years* | *Design year in 25 years* |
|---|---|---|
| 1.5 | 1 4 | 1.35 |
| 1 4 | 1 3 | 1.25 |
| 1.3 | 1 25 | 1 20 |
| 1.2 | 1.15 | 1.13 |
| 1.1 | 1.07 | 1.06 |

# 4 Modifications to Forecasts

4.1 There are a number of factors which may vary the 'normal' trends of traffic growth described in the last section: some of the more important are described in the following paragraph. The uncertainty attached to the effect of these influences and the calculations based on them is likely to be considerable and often renders it desirable to make "high" and "low" estimates.

**4.2 Traffic Diversion**

Where a road is to be constructed along a new route it is necessary to estimate the traffic which can be expected to divert to it from existing roads: diversion may also occur where extensive improvements are made to an existing route. The diverted traffic can best be estimated by means of an origin and destination survey and by assigning traffic to the new or improved road. Assignment may be made by allocating to the new or improved road those journeys which show a saving in time if they are transferred; there are, however, several other assignment methods (see "Research on Road Traffic", pages 137 and 176) and the choice may depend on the type of schemes. It may also be necessary to take account of any projected improvements on the roads from which the traffic is expected to divert; this is dealt with in Section 4.4.

**4.3 Traffic Generation**

Traffic is also increased because reduced journey times generate journeys which would not otherwise have been made. It is not necessary to allow for generated traffic on small schemes, where the effect on overall journey times is likely to be small, but for larger schemes, or small schemes which are part of a larger plan, some allowance should be made. The amount of generated traffic is related to the saving in journey times between the principal places of origin and destination and the allowance for generated traffic should be about twice the percentage decrease in total journey time for each pair of origins and destinations. Further information on this is given in "Research on Road Traffic", page 134. Generated traffic on large schemes has often amounted to between 5% and 25% over and above the normal forecast traffic level. It may be larger in exceptional cases, for example where a new bridge produces drastically shortened journey times. Traffic is also likely to be generated by a new route which avoids or replaces a toll route.

**4.4 Influence of other Road Improvements**

It may at times be necessary to consider the effects of other schemes in the vicinity which are likely to be carried out within the design period (see 5.1). If a motorway, or other major road is to be built, it may draw off traffic and reduce demand on the existing road to a level which reduces the need for new road works. But the relief of an existing road may also attract generated traffic to that road. Once again, a reliable estimate of the change in traffic patterns is dependent upon an origin and destination survey, and by a reassignment of traffic based on estimated reductions in journey times on the motorway or other roads. If no direct information is available it will be necessary to base predictions on experience from other similar schemes.

4.5 In some circumstances, motorway feeder roads for example, traffic will be increased by the presence of the motorway and estimates of increased traffic can be made using the same technique.

**4.6 Influence of Development**

New development near a scheme will normally give rise to additional traffic and a change in the traffic pattern, affecting both road and junction design. The development plans of towns may provide sufficient data to estimate these effects, otherwise an independent survey may be necessary. For town expansions, it is usually sufficient to assume that traffic to and from the town will increase in proportion to the population. In some instances comparisons can be made with the effects of growth in similar towns.

4.7 A change in car parking accommodation or policy, in towns or at railway stations and the like, will have an influence on rural traffic volumes and distribution.

# 5 The Design Period

### 5.1 Design Period

In the planning of large schemes it is necessary to provide sufficient capacity for the future growth of traffic, balancing the practical difficulties of early replacement or extension of a scheme against the uncertainties of the future. A period of 15 years is now recommended for this purpose, calculated from the first year in which the improvement is likely to be in use. In making forecasts in future traffic it is necessary to estimate the flow at the end of the 15 year design period using the methods described in section 3; design capacities of roads, junctions, etc. are then based on this flow. Longer design periods may be used in certain exceptional circumstances, for example where schemes include tunnels or important bridges.

5.2 There will be many cases where no major scheme is envisaged but where a need exists for immediate improvement at a particular point to bring the capacity there up to that of the road generally; shorter design and forecasting periods will then be appropriate. There may even be a need to carry out a limited scheme as an interim measure where a major scheme is in prospect: this is a form of stage construction which is dealt with in the following section.

The choice of appropriate road widths or junction designs to take the expected traffic should be made by reference to the Manual on the Layout of Roads in Rural Areas.

### 5.3 Stage Construction

It is often advantageous to divide a scheme into stages so that future traffic needs are not excessively over provided for in the early years. However, it will seldom be practicable to consider stage construction for a first stage of less than about ten years. The two stages together may well give rise to a design period longer than fifteen years, and consideration must obviously be given to the provision of features in a first stage scheme which will suit probable ultimate conditions; for example, by designing a road and its junctions to permit eventual grade separation.

5.4 It should not be overlooked that at the cost of some loss of speed and comfort roads can and do carry traffic volumes appreciably above the design capacity. For instance, it will generally be preferable in the case of two lane roads to accept substantial overloading if a two lane dual carriageway road is ultimately to be provided instead of immediately building a three lane single carriageway which would become overloaded in a short time. The extent of tolerable overload depends on the design of an individual road and some guidance can be obtained by measuring speed as well as flow, particularly at peak times.

### 5.5 Economic Assessments

In planning schemes the aim is to secure the maximum return, in the form of benefits, from each unit of resources used. Economic assessments help in the taking of decisions by showing which alternatives are likely to secure this end.

5.6 The benefits, which generally take the form of savings in vehicle operating costs and of reductions in travelling time and the number and severity of accidents, are related to the capital and operating and maintenance costs. Although in some cases a first year rate of return gives an adequate guide, it is more often the case that benefits and costs over the life of the scheme must be considered, using discounting techniques to relate sums in the various years.

5.7 Assessments will be especially useful to:

(a) select between alternative (mutually exclusive) proposals for a scheme. This will include cases where staged construction is considered for one or more of the alternatives;
(b) show whether schemes with abnormally high costs are likely to produce sufficient benefits to make them worthwhile;
(c) decide priorities; whether this is necessary because of limited physical or financial resources.

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MINISTRY OF TRANSPORT
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THE WELSH OFFICE

# Advisory Manual on Traffic Prediction for Rural Roads

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This Memorandum has been prepared by the Highway Engineering Divisions, Statistics Division and the Road Research Laboratory of the Ministry of Transport for the guidance of engineers in the design of rural roads.

The information given supersedes that relating to traffic estimation contained in Memorandum No. 780, "Design of Roads in Rural Areas". The latter has been entirely revised and superseded by this manual and the companion manual "The Layout of Roads in Rural Areas". (H.M S.O. London 1968)

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